

SEMICON West 2012

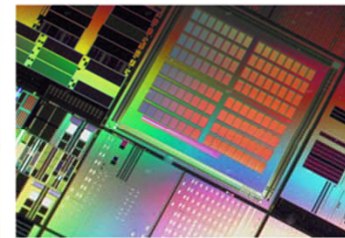
Technical Session Preview

April 4, 2012

SEMICON[®]
West2012

July 10 - 12

Moscone Center, San Francisco

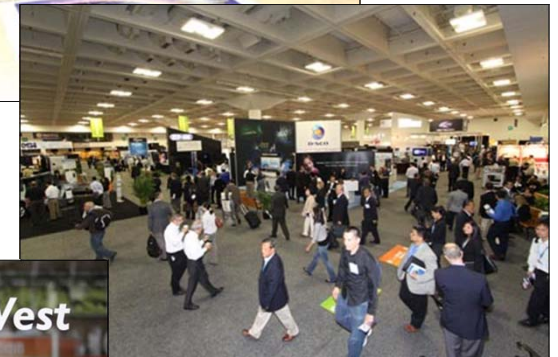


Agenda

- SEMICON West 2012 Overview
- TechXPOT Session Preview
 - Advanced Manufacturing Processes and Materials
 - *Lithography: Extending Double-patterning, Industrializing EUV and Complementary Technologies*
 - *Enabling Sub-22nm with New Materials and Processes*
 - Extreme Electronics
 - *Taking MEMS to the Next Level: Transitioning to a Profitable High Volume Business*
 - *Enabling the Next generation of HB LEDs*
 - *Practical Plastic Electronics: Bringing Disruptive Flexible and Organic Materials into Volume Electronics Manufacturing*
- SEMICON West Technical Session and Program Round-up
- Q&A

SEMICON West 2012

- July 10-12
- Moscone Center, San Francisco
- 600+ exhibitors, 1300+ booths
- 30,000+ attendees
- Co-located with Intersolar North America
- Industries served:
 - Semiconductors
 - LED
 - MEMS
 - Photovoltaic
 - Plastic Electronics
 - Related micro- and nano-electronics



Premier Sponsors:



Comprehensive Coverage



TechXPOTs: Manufacturing Processes & Materials

Lithography: cost is the driver

- Key takeaways from pre-webinar briefings with the speakers:
 - EUVL: it works, but productivity is still an issue; some think using EUV as a cut mask (replacing several 193i masks) holds promise at 14nm or 11nm
 - Directed self-assembly (DSA) is intriguing: it's in its infancy - still don't know all the production issues; might not be ready until 11nm node
 - e-beam direct-write: writing fast with the requisite accuracy is still a challenge - but even if solved, data volume is a huge issue

EUVL milestones

- 6 pre-production tools already in the field
 - 16nm hp lines & spaces; 33mJ/cm²
 - <2nm overlay (dedicated chuck overlay); <7nm (on-product OL)
 - Defectivity: ~0.05PRP (added particles per reticle pass); target is 0.01
 - Productivity: ~5wph (~9W source)
- Production tools to be shipped in 2H12

EUVL challenges: source

- Source productivity being worked to get power to ~20W by 1Q12; requirement is 105-250W (60-125wph) for production in 2013/2014
 - EUV transmission increase
 - Continuous operation
 - Input power increase
 - Conversion efficiency improvement

EUVL challenges: masks

- Reticle defect adders performance is improving (now, consistently below 0.1 per reticle pass); target is <0.01 range
- Actinic mask blank verification/inspection tools and pattern inspection tool are in active development
- Need better understanding of the physical properties of the mask materials (e.g., refractive indices, thicknesses, elemental composition, etc.)
- Mask durability issues: need source power to emulate HVM to be able to study

EUVL challenges: resists

- Resist progress was good in 2011: 16nm hp at 33mJ/cm²; but need to go below 20mJ/cm² to meet throughput targets
- Requiring resists in the 10-15mJ/cm² range will be problematic because of the trade-off between resolution, line-edge roughness and sensitivity
 - Not enough photons necessary to get good LER at that dose
 - Some believe resists will have to be more in the range of 25mJ/cm²

DSA: new kid on the block

- Alternative patterning method using block copolymers
 - Could extend 193i lithography
 - Used in conjunction with a pre-pattern, DSA can reduce the pitch of the final printed structure
 - Can be used to repair defects and repair uniformity in the original print (the repair feature could be used with EUV)
 - Contamination needs to be solved
- Will it be ready for prime time before 11nm?

Another role for maskless litho?

- If e-beam direct write litho succeeds - it could open up the mask business by:
 - Driving design activity (lower NRE costs to take a design to silicon)
 - Using e-beam direct write for critical layers, then do back end layers with conventional photomasks for initial production ramp
 - Then buy a full mask set for HVM when design is proven
- But...e-beam direct write has to work first!

Which litho when?

- Experts seem to agree: a number of different approaches will be used depending on the product/application and cost targets, but EUVL is here to stay
- Scenarios up for discussion below 22/20nm:
 - Replace several immersion masks with EUV cut masks (perhaps around 14nm or 11nm)
 - Use E-beam direct write litho to prove out designs, then switch to EUVL in combination with immersion, etc.
 - DSA at ≤ 11 nm as a grating layer+ 193i; then EUV with a cut mask

Advanced Lithography speakers

*Lithography: Extending Double-patterning,
Industrializing EUV and Complementary Technologies*

Wednesday, July 11, 10:30am-12:30pm, TechXPOT South

- Yan Borodovsky, Intel
- Stefan Wurm, SEMATECH
- Hans Meiling, ASML
- Franklin Kalk, Toppan Photomasks
- Serge Tedesco, CEA-Leti
- Donis Flagello, Nikon Research Corporation of America

Enabling <22nm: addressing power dissipation

- Key takeaways from pre-webinar briefings with speakers:
 - 3D devices (e.g., FinFETs, tri-gate)
 - At some point, all will need to use 3D devices (insertion points depend on specific performance requirements)
 - High-mobility channels (using Ge or III-V materials) in a 3D embodiment will also be necessary at some point (most likely, 11nm and below)
 - Heterointegration (of high-mobility materials) on top of silicon will be challenging but will make SoC easier to do

Heterointegration challenges

- How to deposit:
 - High-quality III-V layers on top of silicon
 - Cost-effectively
 - With low defect density
 - Then build devices

Heterointegration challenges - continued

- Making junctions (implantation doesn't work with III-Vs)
- Making gate stacks
- Selecting the contact material (Au is used now with III-Vs on III-V substrates, but can't be used with III-Vs on silicon)
- Using thick buffer layers with III-Vs on top of silicon won't be cost-effective
- One process being investigated: aspect ratio trapping

Enabling <22nm speakers

Enabling Sub-22nm with New Materials and Processes

Tuesday, July 10, 10:30am-12:30am, TechXPOT South

- Raj Jammy, SEMATECH
- Carlos Mazuré, Soitec
- Kaizad Mistry, Intel
- Aaron Thean, imec
- Christopher Borst, CNSE, University at Albany
- Andrew Skumanich, Advenira

Extreme Electronics: MEMS, LEDs, Plastic Electronics

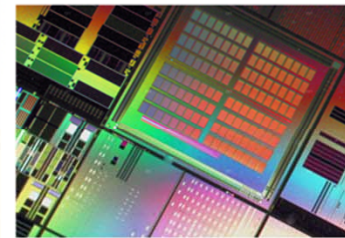
Extreme Electronics Program

SEMICON West 2012

SEMICON[®]
West2012

July 10 - 12

Moscone Center, San Francisco



Extreme Electronics Stage Schedule

Tues

- AM MEMS
- PM MEMS

Wed

- AM HB-LED
- PM HB-LED

Thurs

- AM Printed
- PM ITRS

In cooperation with the MIG

MEMS goes mainstream

- Explosive growth of sensors in smart phones and tablets brought 17% growth in 2011, to \$10.2B market (Yole)
- Main MEMS market analysts IHS iSuppli and Yole Développement see ongoing 10%-15% growth to \$20B future
- But futurists see \$50B opportunity in networked sensors everywhere, Internet of Things

Artisanal niche has to adjust to high volume, low cost markets

- Mismatch of 3-year (at least) MEMS development cycles with 1-year (at most) consumer product cycles
- Market becoming more friendly to IC players
- New crowd of non-expert users need plug-and-play functions
- Big pressure on ASPs

MEMS: Visions of the future and how to get there

- Vijay Ullal, Maxim Integrated Products, Group President, Consumer and Automotive Solutions
 - The future of MEMS
- JC Eloy, Yole Developpement, CEO
 - Growth drivers and how industry can grow more
- Doug Sparks, Hanking Electronics, EVP
 - Capitalizing on growth in the Chinese market

MEMS: Solutions to manufacturing issues

- Nancy Fares, Micralyne, CEO
 - Foundry issues of easing the development flow
- Mike Rosa, Applied Materials, MEMS Global Product Manager
 - Scaling die size: sub micron MEMS
- Matt Kamon, Coventor, Principal Technologist
 - Speeding time to market
- Bill Ross, SEMATECH, Project Manager
 - Mitigating risks of tool obsolescence

Other MEMS events of interest

- Thurs AM Packaging TechXPOT: MEMS & Sensor Packaging
- Thurs AM printed electronics
 - Integration with printed electronics
 - MCIO assembling silicon die on flexible substrates
 - Imprint Energy printed batteries
- MEMS standards meetings
 - Standard test methods, measurement of step height and Young's modulus

HB-LEDs: Making a profitable business out of solid state lighting

- LED backlight boom slows, but LED lighting market is yet to take off
- Major progress in performance, but costs are still too high for lighting market
- And CFLs are getting better, while consumers may be getting disillusioned with the first generation of poor quality LED bulbs
- How can industry get costs down in time? And create value to maintain margins?

LEDs: The big picture

- Jed Dorscheimer, Canaccord Genuity
 - Outlook for industry and reducing costs by yield stacking
- Ilkan Cokgor, Everlight Electronics
 - Packaging solutions to reduce costs
- Mike Watson, Cree
 - Enabling the SSL market

Update on potential of disruptive technologies

- Eric Kim, Sora, CEO
 - GaN on GaN
- Brian Wilcox, Seoul Semiconductor
 - AC and UV
- Bo Lu, Lattice Power
 - GaN on Si
- Eric Virey, Yole Développement
 - GaN on Si

Significant solutions for incremental improvements in performance and yields

- Thomas Uhrmann, EVG
 - Improving light output with nanopatterned sapphire substrates
- Jeff Nestel, GT Advanced Technology
 - What substrate defects impact yield
- Kolja Haberland, LayTec
 - Yield improvement with advanced in-situ metrology








Other LED-related events of interest

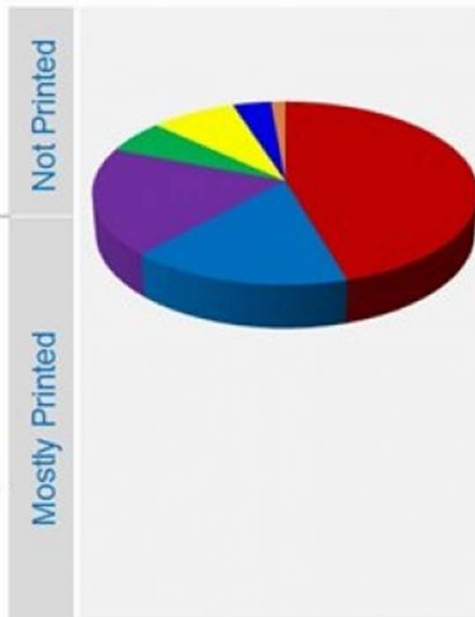
- Tues PM: SEMI Chemical & Gas Manufacturers Group
 - Next Generation Materials
- Thurs AM: Printed/flexible electronics
 - OLED lighting, rigid die on flexible substrates
- HB LED standards meetings
 - 6-inch wafers, interoperability for automation, substrate defects

Printed electronics: Only \$840M of real products, but much bigger potential

The market for printed & potentially Printed Electronics in 2011: **\$2.2 Billion**

BUT most are not printed and are on glass today

-  **OLED Displays \$1 Billion.** Vacuum processed on glass. Mainly Cellphones.
-  **Photovoltaics \$360 million.** Includes only CIGS, OPV, DSSC Most are CIGS – vacuum processed on glass
-  **Other inks: \$420 million.** RFID tag antennas, membrane circuits, bus bars etc. Excludes ESD/RF Shielding
-  **Sensors: \$130 million.** Glucose test strips, ECG sensors, touch screens
-  **E-paper displays \$180 million.** E-readers
-  **Inorganic AC Electroluminescent displays \$80 million.** Signage, Promotional items, Consumer electronics
-  **Others \$30 million.** Printed Batteries, Logic, Memory, Electrochromic displays...



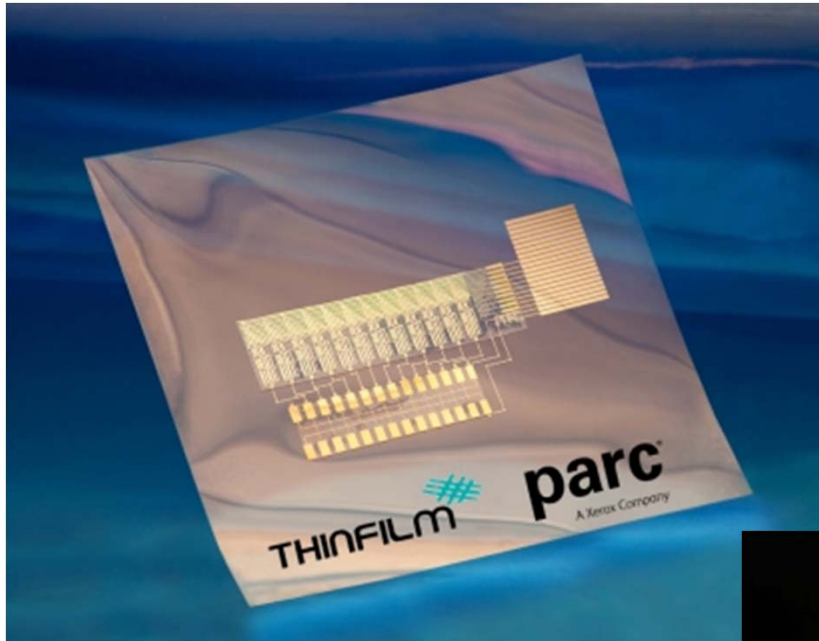
Source: IDTechEx

OLED displays and lighting

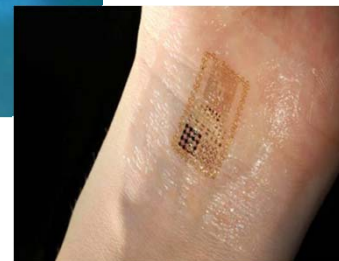
- Serge Biesemans, imec, VP Wafer Technologies & Smart Systems
- Takuya Komoda, Panasonic, Research Director, Core Technologies Development Center



Printed/Flexible Integration



- Devin MacKenzie, Imprint Energy, CEO
- Brian Elolampi, MCI0, Senior Product Engineer



We look forward to seeing you there!



Photo courtesy of MIG

Technical Session Round-up

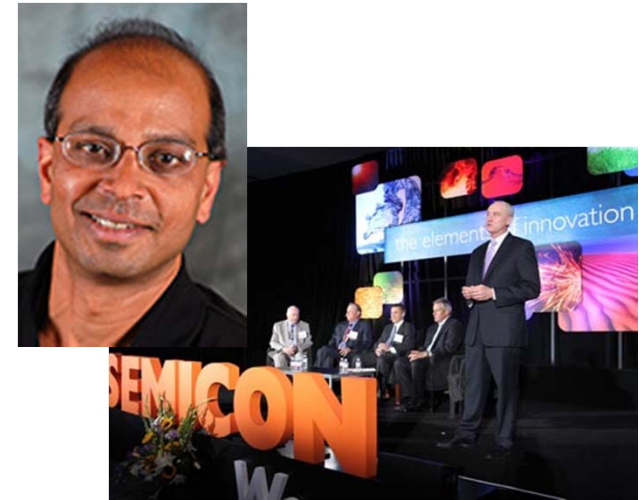
Technical Session Round-up

- *450mm Supply Chain Forum*
 - Thursday, July 12, TechXPOT South
- **Materials**
 - *A Look to the Next Generation of Electronic Materials*
- **Packaging**
 - *Contemporary Packaging: Achieving Cost Advantage Through Innovation*
 - *IEEE/CPMT Workshop: “THIN IS IN”: Thin Chip & Packaging Technologies as Enabler for Innovative Mobile Devices*
 - *The 2.5 & 3D Packaging Landscape for 2014 & Beyond*
 - *MEMS and Sensor Packaging*
- **Test**
 - *New Era of Test*
 - *Highlights of the International Test Conference*

www.semiconwest.org/SessionsEvents

Program Highlights

- TechXPOTs
- Keynotes/Executive Panels
 - Keynote Stage, Esplanade Hall
 - Shekhar Y. Borkar, Intel Fellow, Intel Labs; Director, Extreme-scale Technologies
 - Other keynotes TBA
 - Executive Summit
- Partner events
 - SEMI/Gartner Market Symposium
 - IMEC Technology Forum
 - Sokudo Lithography Breakfast Forum
 - IEEE/SEMI Test Vision 2020 Conference
 - ITRS Technology Sessions
- Customer engagement events
 - VIP reception
 - Happy Hour



Opportunities at SEMICON West 2012

- Attend
 - Visitor registration is FREE through April 12
 - Includes admission to all TechXPOT sessions and keynotes
 - Register at **www.semiconwest.org**
- Exhibit
 - General exhibit space is almost sold out
 - Contact: **sales@semi.org**
- Sponsorship
 - Contact: Marlene Sibley, **msibley@semi.org**

Q&A

Thank You!

SEMICON West 2012

July 10-12

Moscone Center, San Francisco

www.semiconwest.org

Premier Sponsors:

ADVANTEST

 **APPLIED
MATERIALS**

KLA Tencor
Accelerating Yield

SEMICON
West 2012